New LCA Theses

From Material Flows to Cash Flows – An Extension to Traditional Material Flow Modelling

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As the importance of environmental protection and early recognition have gained increasing attention, different tools of environmental management have been developed to assess the environmental impacts of products / companies / industries: Environmental auditing, environmental impact assessment, life cycle assessment, risk assessment, cost benefit analysis, input-output analysis, etc. Several different quantitative models are used to measure flows of products and/or substances through a defined system and to help in decision-making on the basis of these inventories and the studied environmental impacts. According to the system boundary and level required, different methods of material flow analyses can be used: Life Cycle Assessment (LCA) measures and assesses environmental impacts of a single product or an industry along its life cycle; eco-balance concentrates on the environmental impacts of a given company and substance flow analysis (SFA) traces the path of a selected substance through the system.

Material flow models have typically failed to address the economic or social aspects of the system. However, not only environmental resources, but also financial resources for environmental protection are scarce. For this reason, several bodies (e.g. SETAC, ConAccount and CHAINET) engaged in the development of material flow models have recently made recommendations about including economic and social variables in the above-mentioned models. Applications of LCA include such areas as product development and improvement, strategic planning, public policy-making and marketing. When making decisions in any of the above-mentioned situations, information about the economic consequences of the possible outcomes, however, is also crucial. For example, decisions between different product alternatives and their marketing without detailed economic analysis sounds somewhat unrealistic.

Whilst the idea of combining economic data with material flows has gained wide support, very little research has been done in this area to date. There is some empirical work done in this field but any guidelines and principles of how this should be done in a uniform way are missing. The purpose of this particular study has been to discuss the applicability of material flow models in economic decision making and to increase understanding about the possibilities of combining economic data with material flows. The study is exploratory research and the research methods applied are secondary data analysis and case analysis. Cases include examples from the Finnish and Austrian paper industry and waste management. The goal of the author has been that the results of this study would offer a useful contribution to the on-going discussion and be of help for practitioners of material flow management when implementing economic evaluations combined with material flow analysis.

In material flow analysis, a distinction between two levels of analysis can be made: Goods and material level. The goods level can serve as a basis for several different types of analysis. The approach suggested in this thesis is to include economic parameters into material flow modelling, i.e. economic assessment would be a sub-system of the goods level and it would be a parallel analysis to substance flow analysis, energy analysis, water balances, etc. For economic analysis the goods level is interesting because the goods have economic value and are thus responsible for cash flows. For environmental analysis, instead, the material level is more important because the materials in goods cause the environmental problems.

The system boundary is defined within the overall goal and scope definition of the study and it does not need to be considered separately for economic analysis. The system boundary also defines which costs/revenues are to be included in economic analysis. Therefore, there are no social costs or externalities in the sense of how they are usually defined.

The results of this kind of analysis present results from each subsystem (environmental impacts, economic analysis, etc.) separately as absolute figures. It is argued that this is more transparent for the decision maker. No inherent valuation integrating the results of different sub-systems is made and, instead, the decision maker will have to face the problem of valuation himself. A number of separate techniques and tools have been developed to provide assistance in multiobjective decision-making situations.

The suggested approach does not require any new, revolutionary method of cost accounting. Instead, it uses the traditional methods of cost accounting in a broader environment. The effort given for collection and estimation of each cost element has to be in proportion to its overall importance in cost calculations. Rational cost accounting should therefore start from the most significant costs.

Material flow models have proved to be a powerful tool for environmental decision-making and it is argued in this thesis that they also offer a suitable basis for economic evaluation and decision making. The balance between economy and ecology is an ideal situation often repeated in political discussion as well as in the strategic planning of a company. In fact, in most decision-making situations we still miss decision aids which could offer information both about environmental and economic impacts of the possible outcomes. The most important advantages of combining economic variables into material flow models include the communicative value of monetary terms to the decision maker as well as the basic quantitative data offered by material flow models about the system, its logistics and flows, which in most cases is directly useful for economic calculations.

Environmental issues are also business issues and the importance of the cost aspect in environmental protection is definitely increasing in the future, as more developed and expensive technology will be needed. That is why these two decision factors should not be seen or approached separately. Profitability is a basic requirement for any business – and this also applies to environmental management issues. Decisions about environmental protection have to be based on information about what is ecologically justified, technologically possible and economically reasonable. This means that we need reliable and effective methods for the assessment of environmental and economic impacts of future decisions for those who are responsible for strategic decision-making both in the public sector as well as within companies. New approaches to combine environment and economics are needed and material flow analyses complemented with economic assessment as an inherent subsystem are applicable for this purpose.

Copies of the thesis (FIM 130 plus mailing fee) are available at: University of Jyväskylä, Publishing Unit, F: +358-14-260 3471; e-mail: myynti@bibelot.jyu.fi